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DYNAMICS OF PLAYA LAKES IN THE TEXAS HIGH PLAINS

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PREFACE

The ultimate objective of this project is to correlate ERTS-1 satellite imagery signatures with the water balance ecosystem and geology-morphology of select lake basins in West Texas. Work to-date has concentrated on securing ground-truth and the correlation of the ground-truth with the satellite MSS imagery. MSS imagery has been found useful for taking a rapid regional wet census of the tens of thousands of lake basins. Work now in progress, and to be concluded during the next reporting period, is concentrating on correlation of ground-truth and MSS imagery with CCT data so that a regional lake census can be reliably produced from CCT data alone. The correlation of satellite imagery with water fluctuations and water depths in the lake basins, as well as with the water budget, is also underway.

DYNAMICS OF PLAYA LAKES IN THE TEXAS HIGH PLAINS

INTRODUCTION

The purpose of this report is to describe work performed on ERTS-1 study sites under NASA contract NAS 5-21720, proposal number 342-C, during the six-month period of October, 1972 - March, 1973.

Ground-truth studies at the Double Lake site consisted of geologic mapping and soils mapping. Drilling, to determine the extent and thickness of the lacustrine fill and morphology of the large lake basin site (Double Lakes), began on March 27.

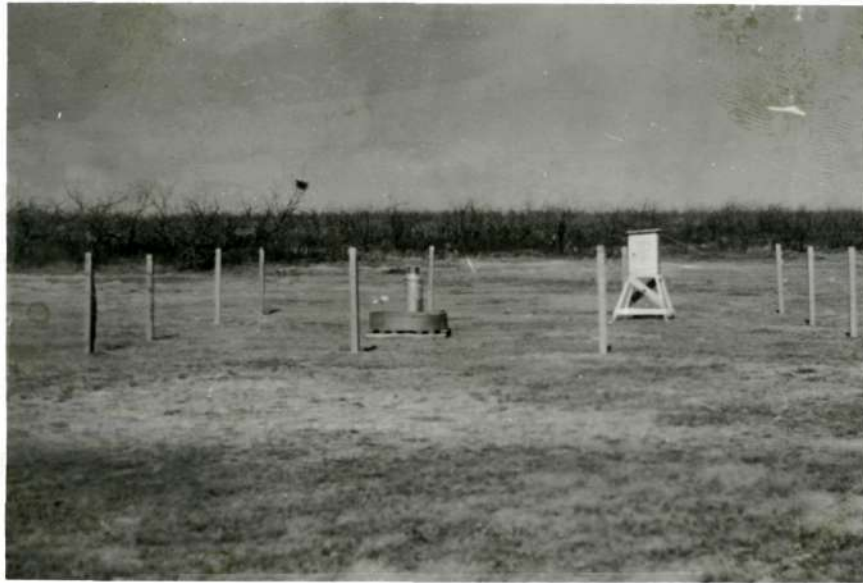
Use of ERTS-1 imagery for providing a wet census of the tens of thousands of lake basins in the study area is being investigated. A test program utilizing imagery and CCT's has been submitted to the Texas Water Development Board for funding.

A study of the correlation of signatures from CCT's and MSS imagery is also underway.

TEST SITES

Present work is concentrating on two test sites located in Lynn County, Texas. A small playa lake basin (T-Bar), representative of the tens of thousands which characterize the Plains, is located approximately 6 miles south of the Double Lakes test site, a dual playa approximately 5 miles long, which is representative of the large pluvial lake basins found in the world's arid lands. Both test sites are fully instrumented (Fig. 1) for

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Figure 1 - Instrumentation site at the T-Bar playa
lake study site, Lynn County, Texas.

recording of weather data (precipitation, evaporation, infiltration, wind velocity). Weather records have been collected from the T-Bar site since August, 1972, and from the Double Lakes site since January, 1973. Both test sites have contained water during the course of study, although the T-Bar playa is presently dry.

ERTS-1 DATA

As of March 31, 1973, the ERTS-1 satellite has made 14 passes over the test area. Imagery from 6 of these passes is usable (July 29, August 16, October 9, November 14, December 2, February 12), 6 passes were lost to cloud cover (September 3, 21, October 27, December 20, January 7, 25), and two passes (March 2, 20) have not, as yet, been received.

All MSS bands, in 9 x 9 positive transparencies and 70 mm negatives, are being received, as well as select CCT. Quality is generally excellent except for sporadic electronic noise and scan lines.

WORK PERFORMED

All ground-truth studies have been completed at the T-Bar site and instrumentation is being monitored. Subsurface control (Fig. 2) shows that the T-Bar playa formed over a low in the Pliocene "caprock" caliche surface; however, whether this was produced by original depositional irregularities or post-caliche

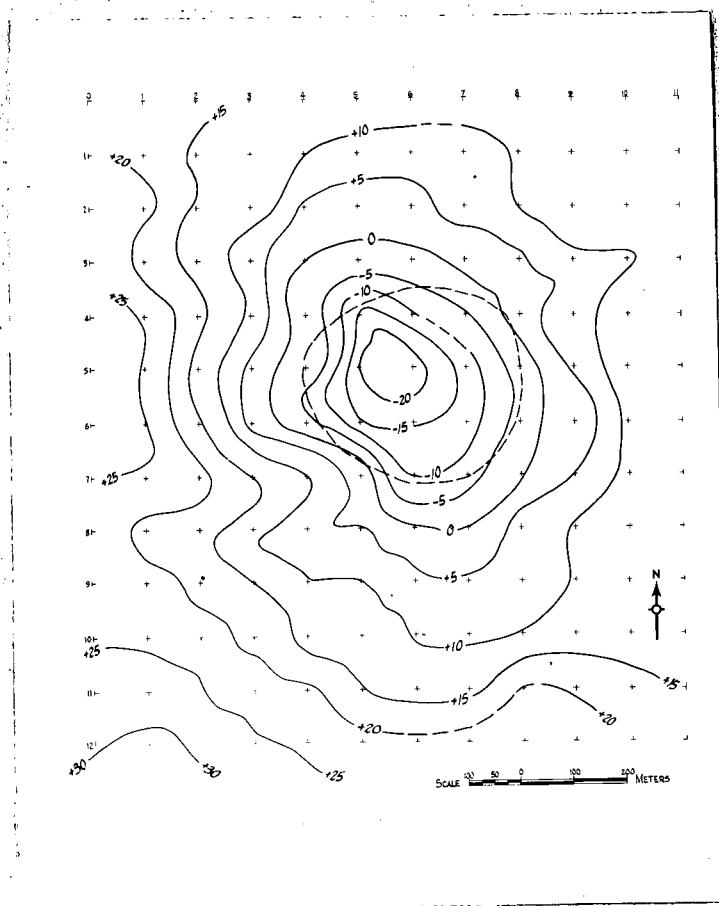


Figure 2 - Structure map on top of Pliocene "caprock" caliche at the T-Bar playa lake site, Lynn County, Texas.

solution of the caliche is presently unknown. Ground-truth studies are still underway at the Double Lakes site due to the late date of initiation, inclement weather and the 9 square mile size of the basin. However, the soil survey and geologic map have been completed, and drilling commenced March 27 to aid in determining subsurface extent of the lacustrine sediments as well as basin morphology. Instrumentation has been installed and monitored since January, 1973.

Visual study of positive transparencies over the study area indicates that a wet census of the lake basins can be made. Lake basins with water and lake basins filled by an individual storm were counted on frame 1006-16522 by Stanford Research Institute personnel. A total of 6,631 filled lake basins were discerned, 353 to 447 being within the recent storm path.

The Lab for Applications of Remote Sensing (LARS), Purdue University, was visited in mid-April. LARS (Dr. Marion Baumgardner, P.I.) is conducting an ERTS-1 project concerning crop and range identification in the Lynn County, Texas, area, using CCT printouts. Computer printouts of the T-Bar and Double Lakes test site (Fig. 3) were secured from LARS and will be utilized with MSS imagery, during the next work period to correlate computer classifications to water and wet mud signatures. Water depths are measured in the North Double Lakes site at the time of select passes.

A summary of work to-date, titled, "Dynamics of Playa Lakes

in the Texas High Plains", was presented at the ERTS-1 Symposium, March 5-9, New Carrollton, Maryland.

A computer program is being written for reconstitution of the CCT's of the scenes over the test area, and initial computer time has been donated to the project by the Computer Center, Texas Tech University.

NEXT 6 MONTHS PROGRAM

Work to be performed during the next 6 months reporting interval is probably the most important of the entire project.

The mass of weather data collected from the test sites will be reduced and correlated (by Meteorologist D. Haragan) with the lake basin parameters to provide a hydrologic budget for each test site. This then will be correlated with the imagery to see if the budgets can be monitored by the satellite products. The correlation of water depth to imagery signatures, and the imagery signatures of wet mud vs. water, in the Double Lakes site (see Fig. 3), will also be concluded.

A visual count of the total number of lake basins in the study area will be completed by Stanford Research Institute personnel and compared to a count determined by CCT data.

The program for constituting portions of MSS scenes in the study area will be completed, allowing computer printouts of the study sites on different passes. The computer printouts will then be compared to the MSS imagery and ground-truth for

proper identification of the computer discriminations - classifications (see Fig. 3).

Installation of two additional color boards and a density control unit on the Density Slicer is scheduled for April 5. This will allow a maximum of 32 color slices and quantitative measurements of transparency density ranges. These capabilities will enhance the accuracy of correlations between the optical products and CCT data printouts.

CONCLUSIONS

Optical analysis of MSS imagery shows that water fluctuations in large lake basins, such as the Double Lakes site, can be monitored. Also, satellite imagery can be utilized to give a wet census of the number of small lake basins which contain water on any one pass. This becomes advisable, from a time and monetary standpoint, where areas, such as the Southern High Plains, contain tens of thousands of lake basins. Individual storm paths can also be traced.

A wet census can also be taken from CCT data, but ground-truth correlation must be conducted in order to determine the number of computer classifications to utilize for differentiation of water from wet muds.

NTIS SUMMARY

Discipline 4 - Water Resources

Subdiscipline - Limnology

The ultimate objective of this project is to correlate ERTS-1 satellite imagery signatures with the water balance ecosystem and geology-morphology of select lake basins in West Texas. Work to-date has concentrated on securing ground-truth and the correlation of the ground-truth with the satellite MSS imagery. MSS imagery has been found useful for taking a rapid regional wet census of the tens of thousands of lake basins. Work now in progress, and to be concluded during the next reporting period, is concentrating on correlation of ground-truth and MSS imagery with CCT data so that a regional lake census can be reliably produced and counted from CCT data alone. The correlation of satellite imagery with water fluctuations and water depths in the lake basins, as well as with the water budget, is also underway.